

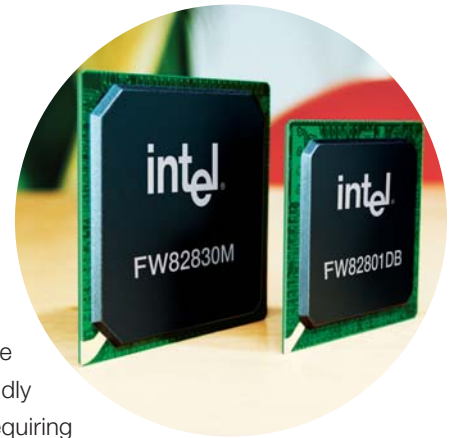


IP-Digital Set Top Box

Based on the Intel® 830M4 Development Platform

Application Description

The IP-digital set top box (IP-DSTB) is a closed box, multi-function consumer electronics client device designed to enable service providers to provision a variety of pre-packaged IP-based services, including IPTV, video, data and voice, in large volume deployments. The digital home environment will rapidly evolve as new digital home devices are deployed, requiring platforms with a high degree of flexibility and interoperability.



Many factors require a high-performance IP-DSTB platform, including the continuing evolution of consumer usage models for digital media, the identification of emerging consumer preferences for specific services, the adoption of new standards, CODECs and protocols for IP video and voice, and the deployment of new applications and middleware.

The flexibility and performance headroom of IP-DSTB platforms based on the Intel® 830M4 chipset helps service providers keep pace with enhanced CODECs and interoperability standards including Universal Plug and Play* (UPnP)*, Digital Living Network Alliance (DLNA), Intel® Networked Media Product Requirements (Intel® NMPR) and Digital Transmission Content Protection (DTCP) over IP.

The IP-DSTB presented here is designed to function as a DSL or Ethernet-based digital set top device with TV-out that can be easily configured with hardware options and software to fit many emerging IP-based service models. It is a versatile platform that provides the headroom needed to address the requirements of a variety of service provider deployment and consumer electronics usage models, including Personal Video Recorder (PVR) applications.

IP-DSTB Platform Requirements Include:

- Flexible processing performance to handle the next-generation applications and services
- Processing scalability based on a flexible platform architecture, to support emerging video CODECs
- Validated platform solutions for reliability and fast time-to-market
- Flexible platform configurations
- Availability of development tools and software
- Intel silicon building blocks with long lifecycle support

Intel® 830M4 Development Platform Block Diagram

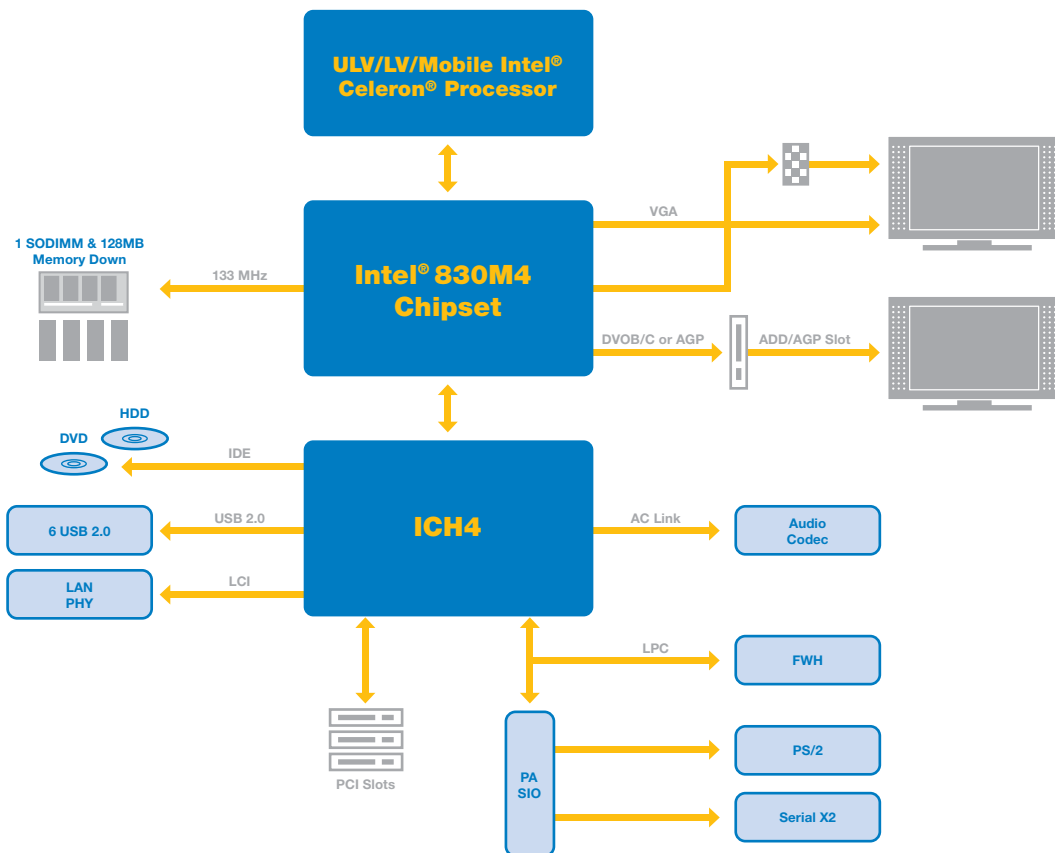


Figure 1 – The Intel® 830M4 Development Platform helps accelerate the implementation of next-generation CE devices and software solutions.

An IP-DSTB platform based on Intel® architecture provides the computing performance to run software CODECs for Windows® Media® Video 9 in addition to MPEG-1, MPEG-2 and MPEG-4 compression formats. The core of the design includes a choice of processors, including the Low Voltage Intel® Celeron® processor, Ultra Low Voltage Intel® Celeron® processor and Mobile Intel® Celeron® processor with the Intel® 830M4 chipset and an Intel® Ethernet controller in addition to video, audio and connectivity components from third-party suppliers. Intel's flexible design enables manufacturers to tailor their own set top box configurations to meet the present and future requirements of service providers and consumers.

- The Low Voltage Intel Celeron processor at 733 MHz provides the performance needed for software-based CODECs.

For higher processing requirements of advanced consumer electronics applications, including graphical user interfaces and electronic program guides (EPG), the design supports Mobile Intel Celeron processors up to 1.26 GHz.

- Expandability is provided through PCI connectors.
- The Intel® 82801DB I/O controller (ICH4) with integrated LAN and ATA/100 provides design flexibility in a full-featured IP-DSTB solution.

The Intel 830M4 Graphics and Memory Controller Hub (GMCH) supports up to 1 GB of PC133 SDRAM with 256 Mb technology. Peripheral expansion includes six USB 2.0 ports for consumer interface devices, video cameras, microphones and other accessories.

Featured Intel Products

Mobile, Low Voltage, and Ultra Low Voltage Intel Celeron Processors

The Mobile Intel Celeron Processor at 1 and 1.26 GHz, the Low Voltage Intel Celeron processor at 733 and 866 MHz and the Ultra Low Voltage Intel Celeron processor at 733 and 800 MHz deliver a scalable processing solution for digital set top box applications. Built on Intel's state-of-the-art manufacturing technology, this processor combines the solid performance needed to run software-based video/audio CODECs, soft DVD MPEG-2 playback, rich user interfaces and a variety of consumer electronics applications, while maintaining exceptional value.

Intel® 830M4 Chipset

The Intel 830M4 chipset, including the I/O Controller Hub4 (ICH4) and Graphics Memory Controller Hub (GMCH) provides increased I/O bus bandwidth through the use of Intel Hub Architecture, enabling the enhanced concurrency needed for next-generation IP-DSTB designs.

The chipset supports up to 1 GB of 133 MHz SDRAM. It includes Intel® 3D integrated graphics for vivid 2D and 3D graphics.

The integrated AC '97 Controller provides high audio quality, and the chipset supports Digital Video Output (DVO). The use of an external DVI interface device enables the set top box to connect to a variety of displays, including traditional TVs and digital flat-panel designs.

Intel® 82562ET 10/100 Ethernet Controller

Intel® 82562 10/100 Ethernet controllers are highly integrated LAN devices that combine 10BASE-T and 100BASE-TX physical layer capabilities and provide a core building block for integrated networking connectivity in ICH4-based platforms.

Functional Description

An IP-DSTB based on Intel architecture is a multi-function platform that is designed to enable flexible implementation of a variety of video, voice and data applications and services.

IPTV and Video

Intel architecture provides a standardized platform to provide flexibility and scalability, with the performance headroom to handle emerging next-generation CODECs, middleware and software designed to optimize the quality of digital video.

An IP video stream is provided by a cable modem or DSL broadband connection. Before arriving at the set top box, this video stream may be encoded using a variety of compression protocols.

The packetized video stream enters the set top box through a 10/100 Ethernet connector and is then decoded by the processor. The processing headroom provided by Intel architecture is ideal for soft decoding. Using soft decode has important advantages, including the ability to change video CODECs without having to add dedicated decoder hardware.

The CPU also builds the frame buffers to be used for display by the graphics controller. Graphics planes, including video on the primary plane and an electronic program guide overlay, are blended in the graphics engine in the GMCH. Graphics generation is needed for user interface and electronic program guide overlays, including a menu overlay with live video backdrop, which requires alpha-blending in addition to complex compositional effects involving multiple video layers.

Post-processing is performed to correct compression artifacts and transmission loss, and video enhancement improves contrast and sharpness reduces noise, with video conditioning to improve resolution and correct scan and rate-mismatch.

Once the video stream has been decoded, the stream needs to be encoded for output into a standard TV format, such as NTSC, PAL, or SECAM. Outputs include composite, S-video, and component.

Voice over IP/Video Phone

The addition of Voice over IP (VoIP) capability enables service providers to support traditional IP-based telephony applications and video-phone services. For example, caller ID, call waiting and call-forwarding applications can run concurrently with IPTV on a consumer's TV monitor. Incoming packets are routed into the platform through the ICH and GMCH and ultimately to the processor, which runs the call-processing application.

To permit two-way voice functionality, the platform is configured with a microphone for audio capture with a supporting module for re-encoding the data into a packetized audio stream. The addition of a camera enables the platform to support video-phone applications, which can be further enhanced by graphical data for services including call waiting and caller ID.

Online Gaming

The IP-DSTB platform also supports online gaming applications. The processing and 3D graphics performance of the Intel 830M4 platform provide the realism and quality needed to enhance the user experience. Players can also communicate with each other while a game is in progress using the platform's VoIP capability.

Software Considerations

The Intel 830M4 Development Platform supports the following software components:

Operating Systems

Intel provides matching Board Support Packages/Platform Support Packages for the latest released versions of supported operating systems:

- Board Support Package for Windows* CE NET 4.2
- Board Support Package for Windows* CE 5.0
- Future Support for Linux* OS

Multimedia Building Blocks

Residing on top of the embedded OS and platform drivers, multimedia building blocks perform specific functions such as audio/video stream decoding. These building blocks also provide a framework for high-level applications and middleware, such as a Java* virtual machine (JVM), or an embedded browser.

Because Intel architecture can deliver significant processing performance, software-based CODECs can help reduce bill of material (BOM) costs for digital set top box platforms. Depending on the needs of the set top box manufacturer, the CODEC provider can deploy the software as part of a media framework provided on a particular OS, or as part of a software development kit (SDK) that allows for easy integration.

A variety of solutions are available for the Intel 830M4 chipset to support multimedia-on-demand capabilities and services, digital rights management (DRM) and features including home networking, Web browsing and real-time VoIP. The software that manages the delivery and service of these capabilities, as well as the core operating system for the set top box, is provided by external software vendors.

Some examples include:

- Software-based CODECs for emerging advanced compression technologies provide the flexibility to implement multiple emerging and existing standards and formats. The use of advanced compression encoding for digital video requires roughly half the bandwidth required for MPEG-2, enabling service providers to distribute video-on-demand and other services over DSL telephone lines.
- Middleware to support DSTB deployments that integrate and manage the delivery of streaming content over IP, as well as provide the user interface to access and display networked digital content.
- Security, Conditional Access and Digital Rights Management (DRM) software

Interoperability Middleware

The Intel architecture IP-DSTB platform is designed to be highly interoperable to enable seamless compatibility with other networked devices in the digital home. The IP-DSTB must adhere to a number of interoperability guidelines including UPnP* A/V, DLNA v1.0 standards and Intel® Networked Media Product Requirements (Intel® NMPPR) v2.1. The set top box must also provide the flexibility to add software modules, including Digital Rights Management (DRM) or soft-CODEC solutions.

Intel® Digital Media Infrastructure middleware provides developers with a ready-to-use interoperability solution for IP-DSTB devices. It consists of production-ready executable code for Media Server, Media Player, Streamer, Media Database, Control Point, and a demonstration user interface. Intel® Digital Media Infrastructure is a turn-key solution that it is ready to use out of the box. It is also extensible, providing the flexibility to add higher-levels of software-based functionality for product differentiation. Intel® Digital Media Infrastructure is delivered to Intel customers as load-and-go binaries pre-tuned for the platform configuration. Together with the Intel 830M4 Development Platform, Intel® Digital Media Infrastructure provides a comprehensive platform kit that can help save weeks of development time.

Security Software

Third-party security software will use algorithms to encrypt and scramble content at the head-end, which is then decoded at the set-top box for playback.

Infrastructure Middleware

The deployment of IP-DSTBs and the associated services are typically driven through the interaction of the service provider and a multimedia infrastructure provider. In deploying the full solution, the multimedia infrastructure provider acts as an aggregator to deliver the client playback stack, encoding solution DRM scheme, provisioning and content management systems to create, encode, package, deliver and manage the multimedia content. Often the multimedia infrastructure provider will collaborate with other ISVs that specialize in DRM and Conditional Access, and/or middleware to provide an optimized, end-to-end solution to the operator.

Applications

When combined with a direct broadband connection between the viewer and service provider, the Intel IP-DSTB design supports a rich menu of triple-play voice, data and video services:

- IPTV
- Video on Demand (VoD)
- Pay-per-view (PPV) video programming
- “Internet video phone” voice+video

Communication via the Internet

The IP-DSTB enables consumers to enjoy a broad range of Internet services and applications from their living room:

- VoIP communications
- Streaming video and audio content
- Online shopping
- Interactive online games
- Web browsing
- E-mail and text messaging

Third-Party Software Support

Intel works with multiple independent hardware and software vendors to help enable quick implementation of designs based on the Intel 830M4 Chipset-based IP-DSTB Reference Design.

More information on third-party software vendors is available at <http://developer.intel.com/design/celelect/vendors/dstb.htm>.

Scalability and Migration Options

Intel's flexible design approach enables manufacturers to tailor a variety of IP-DSTB solutions to meet the varied needs of service providers and consumers. In addition to supporting a range of Intel processors, the platform includes peripheral expansion capabilities, including multiple PCI connectors and USB ports.

In addition to providing a basis for the next generation IP-DSTB design, the Intel 830M4 Development Platform can be used as the basis for PVR capability with the addition of one or more hard drives. Manufacturers can expand their product options even more by adding tuners for broadcast TV, remote-control units, joysticks and game controllers, in addition to wired and wireless home networking options.

The addition of a hard disk drive and an optional tuner/encoder card enables a platform designed around the Intel 830M4 chipset to support a variety of usage models. With a hard drive, a 'trickle' VoD model can be enabled where video and other content can be downloaded (non-real-time) based on end-user preferences. This allows service providers to offer recommendations of a variety of specialty content.

The hard drive also enables an Intel 830M4 chipset-based platform to be a PVR where end users can do PVR 'trick modes' such as live-pause, live-rewind and skipping features on content delivered via DSL. With an optional tuner, the Intel 830M4 chipset-based platform can also receive local terrestrial broadcasts.

The Mobile, Low Voltage, and Ultra Low Voltage Intel Celeron processor families provide product developers with a scalable path that helps preserve their hardware and software investments over multiple-product generations. The ability to use a single-system design that supports a wide range of price and performance options enables developers to rapidly add product features and functionality while minimizing their total system cost.

Recommended Development Tools

Intel provides building blocks that work together in specific configurations to support simple and fast development of applications designed for consumer electronics. These building blocks can also be used to provide the high levels of scalable performance and reliability required by today's demanding applications.

Recommended development tools include:

- Development Platform
- Board Support Package/Platform Support Package
- Appropriate Platform and Graphics Drivers
- Intel Digital Media Infrastructure Stack
- Documentation
- Developer Manual
- Platform Design Guide
- Application Notes
- Schematics
- User Manual
- White Papers

Intel 830M4 Development Platform

The Intel 830M4 Development Platform is a single-board development kit that is used to dramatically accelerate IP-DSTB designs based on the Intel 830M4 chipset. When combined with BIOS, operating system and application software, it provides hardware and software developers with a validated IP-DSTB platform.

The base configuration provides IP-DSTB manufacturers with the flexibility to quickly meet the requirements of service providers by adding a variety of processors and I/O options for multiple input, TV encoder and storage devices. The development platform enables developers to quickly take advantage of the performance and capabilities of the Intel architecture components, including selecting the different hardware interfaces that best fit specific customer requirements. The platform offers options for use of the AGP Digital Display (ADD) interface, AGP interface, and a DVO interface for use with a broad range of TV encoder or graphics cards. This scalable platform helps manufacturers minimize development by helping to simplify hardware designs and minimizing bill-of-materials costs.

Windows* CE 5.0 Board Support Package

Consumer electronics equipment manufacturers and software vendors can accelerate their product development using the new Windows* CE 5.0 Board Support Package for the Intel 830M4 Development Platform. The Board Support Package is validated in the Microsoft* Platform Builder Environment,

an integrated development environment (IDE) that includes the tools necessary to design, build, test and debug Windows* CE-based applications. The Board Support Package includes the library of drivers needed to build an image for applications designed for next-generation IP-DSTBs, digital media receivers and other consumer electronics client devices.

Product Kit

Intel Digital Media Infrastructure is a comprehensive turn-key media sharing and rendering based product kit that is provided at no cost to Intel consumer electronics platform customers. It includes executable code for Media Server, Media Player, Streamer, Media Database, Control point, and demonstration user interface. In addition to source code and build files, it includes templates and examples for DLNA and UPnP.

- For more information on the Intel 830M4 Development Platform and Intel Digital Media Infrastructure middleware, contact your Intel representative. An overview of the Development Platform is also available at <http://developer.intel.com/design/celect/830m/prodbref.htm>
- For more information on the Windows* CE 5.0 Board Support Package for the Intel 830M4 Development Platform, see the online overview at <http://developer.intel.com/design/celect/830m/830m4news.htm>
- For a comprehensive list of Intel architecture software development tools, refer to the Intel Electronic Tools Catalog at <http://appzone.intel.com/toolcatalog/>

Intel Design Advantage

Time-to-Market

Intel provides a comprehensive development platform that can dramatically accelerate time-to-market and works with independent hardware and software vendors to quickly enable the implementation of designs.

Cost-Effectiveness

An Intel-validated development platform, including schematics and documentation, is available at no cost. Developers can reduce development costs even further by utilizing the substantial amount of platform engineering work already performed by Intel.

Flexibility and Performance

The Intel 830M4 Development Platform is ideally suited for the IP-DSTB IPTV market segment and is designed to meet low-cost, high-performance product targets. Support for multiple operating systems and a variety of expandability options are available to help developers meet customer requirements.

Scalability

The Intel product roadmap enables developers to meet the evolving processing requirements of IP-DSTBs.

Quality

Intel's manufacturing capacity and quality requirements help ensure processor and chipset reliability for customer satisfaction.

Broad Application Support

The platform is validated with the Microsoft* Windows* CE operating system, providing developers who adopt the reference design with a significant time-to-market advantage.

Enhancing Design Flexibility

By providing the flexibility to implement multiple configurations using a single platform design, the IP-DSTB based on Intel architecture can support a variety of emerging business models that take advantage of the revenue-generating potential of IP-based digital media.

Service providers have the flexibility to evaluate new services, ranging from IPTV and VoD to integrated voice over IP, gaming and interactive video services. The use of Intel silicon building blocks, the validated Intel 830M4 Development Platform and software from a variety of third-party vendors enables fast time-to-market while minimizing development costs.

**For more information, visit the Intel Consumer Electronics home page at:
www.intel.com/go/consumerelectronics**



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